

REVIEW ARTICLE

Positron emission tomography (PET) for cholangiocarcinoma

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*From the Swiss HPB (Hepato-Pancreato-Biliary) Center, Department of Surgery, University Hospital Zurich***Abstract**

The combination of positron emission tomography (PET) with computed tomography (PET-CT) provides simultaneous metabolic and anatomic information on tumors in the same imaging session. Sensitivity of PET/PET-CT is higher for intrahepatic (>90%) than for extrahepatic cholangiocarcinoma (CCA) (about 60%). The detection rate of distant metastasis is 100%. PET, and particularly PET-CT, improves the results and impacts on the oncological management in CCA compared with other imaging modalities. Therefore, PET-CT is recommended in the preoperative staging of intrahepatic (strength of recommendation: moderate) and extrahepatic (strength of recommendation: low) CCA.

Key Words: Cholangiocarcinoma, computed tomography (CT), positron emission tomography (PET)

Introduction

Cholangiocarcinoma (CCA) is a rare disease accounting for <2% of all human malignancies. In some patients, surgery currently offers the only chance for long-term survival and cure [1,2]. The differential diagnosis includes both benign and malignant diseases, such as pancreatic head carcinoma, ampulla of Vater carcinoma, Mirizzi's syndrome, benign strictures, primary sclerosing cholangitis, and echinococcosis. An extensive work-up is mandatory if tumor stage is to be defined accurately, with a particular emphasis on detecting distant metastases to identify the patients who may benefit from surgery. Modalities of imaging work-up include ultrasound, spiral contrast-enhanced computed tomography (ceCT), magnetic resonance imaging (MRI), magnetic resonance cholangiopancreatography (MRCP), and more invasive techniques, such as endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous transhepatic cholangiography (PTC).

The PET technique

In contrast to these imaging modalities, positron emission tomography (PET) provides metabolic information on tumors, rather than anatomical data on the localization of a lesion. This technique avails the

high utilization of glucose in tumor cells. As a radiolabeled tracer, the 18F-fluoro-2-deoxy-D-glucose (18 FDG) is transported into tumor cells by membrane glucose transporter proteins (GLUT). 18 FDG is phosphorylated by hexokinase to FDG-6-phosphate, a highly polar molecule which cannot diffuse out of cell. The higher rates of phosphorylation due to an overexpressed hexokinase in malignant cells lead to increased metabolism of the glucose in cancer tissue which is visualized by PET.

However, PET is limited by poor resolution and poor anatomic localization of positive lesions, and as a result the diagnosis must ultimately rely on an approximate correlation between findings obtained on CT or MRI and the PET scan. To overcome this limitation, a new technique combining data of a full ring PET scanner with a multidetector row helical CT in the same imaging session has been developed (PET-CT) [3]. With this technology, the PET positive lesions are projected directly into the CT scan to obtain simultaneous metabolic and anatomic information.

Trials

There are still few trials published on PET in intrahepatic and/or extrahepatic CCA (Table I)

Table I. Series of positron emission tomography (PET) and PET associated with computed tomography (CT) reported in the literature.

Author	Patients	Method
Fritcher (2001) [4]	15	PET
Kluge (2001) [5]	26	PET
Kato (2002) [6]	34	PET
Kim (2003) [7]	21	PET
Petrowsky (2006) [8]	41	PET-CT
Moon (2007) [9]	54	PET
Jadvar (2007) [10]	24	PET-CT

[4–10]. Most studies are focused on staging by PET alone; only two of them evaluate PET-CT. All of the trials are cohort studies on consecutive patients with a relatively low number of patients.

PET alone

The sensitivity of PET (without CT) is higher compared to ceCT in intrahepatic CCA, ranging between 91% and 95%. For extrahepatic CCA, the sensitivity to detect the primary tumor is between 60% and 90%, which is comparable to ceCT. The discrimination between primary tumor and local lymph node metastases in PET scan is difficult, therefore the sensitivity of local lymph node metastasis PET is low (between 13% and 50%). In contrast, the detection rate for distant metastases is high, PET sensitivity having been reported between 65% and 94%. In the particular situation of primary sclerosing cholangitis, PET has been reported as a useful tool for excluding CCA (sensitivity of 75% and specificity of 95%).

PET-CT

PET-CT in cases of CCA have only been evaluated in two studies. According to Petrowsky et al. [8], the sensibility and specificity of PET-CT for intrahepatic CCA (93% and 80%, respectively) are better than of ceCT. For extrahepatic CCA, the values of PET-CT are 55% (sensitivity) and 33% (specificity), which is comparable to ceCT. In the same study, the sensitivity and sensibility of PET-CT for detection of distant metastases was 100% each; however, the sensitivity of regional LN metastases was 12% (specificity of 96%). Javar et al. [10] focused on tumor recurrence and metastasis, support the very high detection rate for distant metastasis for CCA (sensitivity 94%, specificity 100%).

Conclusion

PET, and particularly the combination of PET and CT, improves the results and impacts on the oncological management in CCA. PET/PET-CT showed higher sensitivity for intrahepatic CCA than for extrahepatic CCA. PET/PET-CT is reliable for detecting distant metastasis but unreliable for assessing regional lymph node metastases.

Consensus statement

- PET-CT is recommended in the preoperative staging of intrahepatic and extrahepatic CCA.

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